SINGLE-PHASE DIGITAL ENERGY METER

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It is being well recognized that one of the major reason for electrical energy loss and waste is lack of accountability. In order to properly audit energy consumption in different departments in distributor's and consumer's networks, it is required to monitor power consumption in boundaries. This will demand accurate and cost effective monitoring equipment such as a digital power meter. A PIC based digital energy meter is a good contender for this purpose, with remote metering and web based billing can also be incorporated.

The work presented in this paper explains the design and implementation of a single phase digital energy meter, which is having two sensor modules, a data processing module, a user interface and a PC interface. Voltage and current sensors are two separate modules, which sense voltage and current of the main power line. The main power line voltage values are mapped in to an analogue voltage signal with the range of 0~5V. It is assumed that the main supply voltage cannot exceed 240V. So the voltage is stepped down and linearly mapped with 0~5V by the voltage sensor module.

One of the key features of this meter design is, facilitating of switched scaling, which was incorporated to increase the accuracy of the meter in current measurement. By and large, in a single phase domestic load, the current is less than 30A. But it may grow up to 50-60A in some sporadic circumstances. Therefore the current sensing module is implemented with two 0~5V output scale circuits, which are mapped with 0-30A and 0-60A of input current ranges. Depending on the transient current value in domestic load, the data processing module automatically selects either one of these current scale circuits.

Data processing module consists of a PIC16F877A micro controller, which is fed by sensors with three voltage signals. Input signals are sampled with the built-in A/D converters of the PIC and their instantaneous values are driven. To reduce the errors due to the delay in A/D conversion, voltage signal is sampled two times before and after the current sampling, and the average voltage is taken for the process. For the current measurement, the output of 0~30A scale circuit is taken as the default. If this value reaches 5V then the 0~60A scale circuit is taken as input source. So, this switching of scaled input is automatically done respect to the sensed transient current on main supply. From these instantaneous values all other parameters such as instantaneous power, cumulated energy, power factor, average power, apparent power and the peak values are driven by using several mathematical algorithms.

User interface module consists of an LCD to display the parameter and its value according to the user's request. Push buttons help users to select the parameter to be displayed. PC interface is a serial interface with the data processing module, and which is used to calibrate the meter initially and for continuous data monitoring.

This research work boosts energy meter technology with the newly added scaling circuitry to increase its accuracy and measurement range.

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